United States General Accounting Office

GAO

Report to the Chairman, Legislation and National Security Subcommittee, Committee on Government Operations, House of Representatives

September 1992

STRATEGIC DEFENSE INITIATIVE

Some Claims Overstated for Early Flight Tests of Interceptors

GAO/NSIAD-92-282

Accession Number: 3759

Publication Date: Sep 01, 1992

Title: Strategic Defense Initiative: Some Claims Overstated for Early Flight Tests of Interceptors

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Corporate Author Or Publisher: U.S. General Accounting Office, GAO, Washington, DC 20548 Report Number: GAO/NSIAD-92-282

Comments on Document: Report to the Chairman, Legislation and National Security Subcommittee on Government Operations, House of Representatives

Descriptors, Keywords: GAO Report Kinetic Kill Interceptor KITE ERIS LEAP Brilliant Pebbles BP Ballistic Missile Defense ICBM Optical Sensor BMC3 Battle Management Command Control Communication Flight Test

Pages: 00042

Cataloged Date: Sep 25, 1992

Document Type: HC

Number of Copies In Library: 000002

Record ID: 24823

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United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-223094

September 8, 1992

The Honorable John Conyers, Jr.
Chairman, Legislation and National
Security Subcommittee
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

This report responds to your request that we review the accuracy of the Strategic Defense Initiative Organization's claims about the results of flight tests of kinetic kill interceptors. As agreed, we reviewed all seven flight tests conducted from January 1990 through March 1992.

As arranged with your office, unless you publicly announce this report's contents earlier, we plan no further distribution of it until 30 days after its issue date. At that time, we will send copies to appropriate congressional committees; the Secretaries of Defense and the Army; and the Directors, Strategic Defense Initiative Organization and Office of Management and Budget. We will also make copies available to others upon request.

This report was prepared under the direction of Brad Hathaway, Associate Director, who may be reached on (202) 275-4265 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix I.

Sincerely yours,

Frank C Conahan

Frank C. Conahan
Assistant Comptroller General

Executive Summary

Purpose

The Strategic Defense Initiative program is developing a family of kinetic kill interceptors to destroy missiles by colliding with them. From January 1990 through March 1992, the Strategic Defense Initiative Organization (SDIO) conducted seven flight tests of early experimental versions. The Chairman, Legislation and National Security Subcommittee, House Committee on Government Operations, asked GAO to determine the accuracy of SDIO's claims for these tests.

Background

Kinetic kill interceptors use head-on collisions up to 30,000 miles an hour to destroy targets. SDIO is developing three types of kinetic kill interceptors that would attack a ballistic missile at different points in its flight path. Brilliant Pebbles, a space-based interceptor, would attack targets first. Then a ground-based interceptor would attack targets above the earth's atmosphere (exoatmospheric). Finally, a different ground-based interceptor would attack targets after they have reentered the earth's atmosphere (endoatmospheric). Each uses different technologies that SDIO must develop and then demonstrate through flight testing. (See fig. 1.1.)

Results in Brief

SDIO claimed that five of the seven flight tests were successes and the other two were failures. GAO concluded that SDIO inaccurately described some results of four of the seven tests.

Table 1: Accuracy of SDIO's Testing Claims

Flight test	SDIO claims about test	GAO's conclusions
Tests with some inaccurate claims		
KITE 1	Shroud design validated	Inaccurate
	Window cooling system validated	Accurate
ERIS 1	Successful test	Accurate
	Target discrimination achieved	Inaccurate
LEAP 1	Successful test	Accurate
	Altitude and accuracy goals met	Inaccurate
BP 2	90-percent successful	Inaccurate
	Increasingly sophisticated tests	Inaccurate
	Completion of Phase I testing	Inaccurate
Tests with accurate claims		
KITE 2	Failure	Accurate
ERIS 2	Limited success	Accurate
BP 1	Failure	Accurate

Principal Findings

One KITE Flight Test Claim Not Supported by Test Results

The goal of the Kinetic Kill Vehicle Integrated Technology Experiment (KITE) is to demonstrate key technologies for a ground-based interceptor. It would destroy enemy nuclear warheads as they reenter the upper part of the earth's atmosphere, about 62 miles (100 kilometers) above the earth. An optical sensor is inside the interceptor, which has a window for the sensor to look through to find the target. (See fig. 2.1.) During the first 5 to 10 seconds of flight, a protective shroud covers the window. Then the shroud must be removed without damaging the interceptor. Due to the severe heating of the window by the atmosphere, the window would become opaque unless cooled. If the window were opaque, the optical sensor could not see through it to find the target. The purpose of the KITE-1 flight test was to show that the shroud and the window cooling system worked properly.

The Army Strategic Defense Command's news release claimed that the KITE-1 flight test in January 1990 validated the design of the shroud. Test reports show it did not. The shroud broke off in pieces and hit the vehicle. SDIO redesigned the shroud using a different material and plans to flight test it again. The news release also claimed that the flight test validated the window cooling system design. Test reports show it did.

The Army Strategic Defense Command said that the KITE-2 flight test in September 1991 was a failure. The interceptor was destroyed by the premature detonation of the flight termination system explosives while the interceptor was starting to move from the launch pad.

One Exoatmospheric Interceptor Flight Test Claim Not Supported

The purpose of the Exoatmospheric Reentry Vehicle Interceptor Subsystem (ERIS) program is to resolve technical issues associated with development of a ground-based interceptor to destroy warheads above the earth's atmosphere. The most difficult problem is that the interceptor may have to pick out the target among various decoys. SDIO has conducted two ERIS flight tests. Although the first test in January 1991 successfully achieved its planned goals as claimed, SDIO and the Army Strategic Defense Command also claimed that target "discrimination" was demonstrated. This claim is inaccurate. The second ERIS flight test in March 1992 failed to intercept the target. SDIO and Army Strategic Defense Command press releases explained why the intercept did not occur and claimed that the test achieved all the other major goals. GAO found that this claim is accurate.

Lightweight Exoatmospheric Projectile Claims Overstate Success

The Lightweight Exoatmospheric Projectile (LEAP) is a technology program to develop the smallest, lightest, kinetic kill interceptor possible. The first flight test in February 1992 was a dress rehearsal to check out test support hardware and procedures. The test used an older projectile in place of a new expensive LEAP projectile.

SDIO claimed, based on preliminary flight test information, that the checkout test was successfully completed. SDIO said that the experiment had reached the required altitude, had accurately positioned the target and projectile for a test, and had wrung out all procedures necessary for future LEAP tests.

GAO agrees that the test was successful in satisfying its general goal of eliminating problems in the test setup. However, test information available at the time of the press release showed that the experiment had not reached the altitude claimed. Also, information available at that time on the relative positions of the target and projectile did not provide the accuracy to positively conclude that they were positioned correctly. Preliminary information indicated that the articles may have been positioned properly, but this could only be verified later, using detailed test data. (See fig. 4.1.)

Some Brilliant Pebbles Flight Test Claims Overstated

SDIO is developing Brilliant Pebbles to destroy ballistic missiles early in their flight. SDIO's Integrated Test Plan had four test goals for the first two flight tests. The first test in August 1990 failed when a malfunction 81 seconds after launch ended collection of information. This prevented transmission and recording of performance information from the interceptor. SDIO's statements to the press and Congress said that the test failed to collect useful information on the interceptor's performance. The second test in April 1991 repeated the first test's scenario. It was partially successful. However, SDIO made several statements that overstated the test results and technical progress represented by the test.

In a press briefing the day after the test, SDIO characterized the test as about a 90-percent success. When challenged by the Chairman of the Legislation and National Security Subcommittee during a hearing on May 16, 1991, about SDIO's claim of success, the SDIO Director repeated the 90-percent success claim and said that the test "accomplished all of the main objectives of the test." A few weeks later in a letter to the Chairman he said that he stood by SDIO's characterization of the experiment's success and that the Committee's questions about the claim of 90-percent success

did not reflect a complete understanding of the four test goals as further defined in the Mission Experiment Description. There was nothing in the letter explaining that there were significant reductions in test goals, other than the phrase "further defined." The Mission Experiment Description set forth six revised goals that were significantly different from the original four goals with respect to the technical performance that was to be demonstrated. SDIO did not adequately disclose the reduced goals outside SDIO.

During GAO's review, the Brilliant Pebbles Test Director said that the 90-percent success statement was his qualitative assessment of how well the test went when compared with the revised set of six goals. Brilliant Pebbles program officials said the test met five of the six goals, which would be an 83-percent success if all the goals were equally important. This was a reasonably accurate claim if measured against the substantially reduced test goals.

SDIO also said this flight test completed the second in a series of successively more difficult tests and that this completed Phase I of their test program. These statements gave the inaccurate impression that, with the completion of the first two tests, SDIO had achieved the technical goals it had set for these tests. If the first two tests had been done as planned and had been successful, SDIO would be in a position to begin the next phase with minimum risk. The actual test results accomplished much less than planned. First, the acquisition and tracking software that is essential for intercepting a target was never tested, although it was supposed to be on both tests. Development of the software was behind schedule and was not available for testing. In addition, because acquisition and tracking did not occur, other test goals were not accomplished. Finally, the more difficult second test in daytime against the earth background was never done. SDIO instead repeated the first test that failed, which was at night against a space background.

Agency Comments

GAO discussed its preliminary work results with responsible SDIO officials and has included their comments where appropriate. These officials raised concerns that GAO had not adequately explained its methodology for comparing Brilliant Pebbles test results with test goals as discussed in chapter 5. GAO has included additional information in chapter 5 to reflect SDIO's belief that a revised set of goals should have been used to evaluate the claim of 90-percent success for flight test 2. As requested, GAO did not obtain written comments on a draft of this report.

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Abbreviations

ERIS	Exoatmospheric Reentry Vehicle Interceptor Subsystem
KITE	Kinetic Kill Vehicle Integrated Technology Experiment
LEAP	Lightweight Exoatmospheric Projectile
SDIO	Strategic Defense Initiative Organization

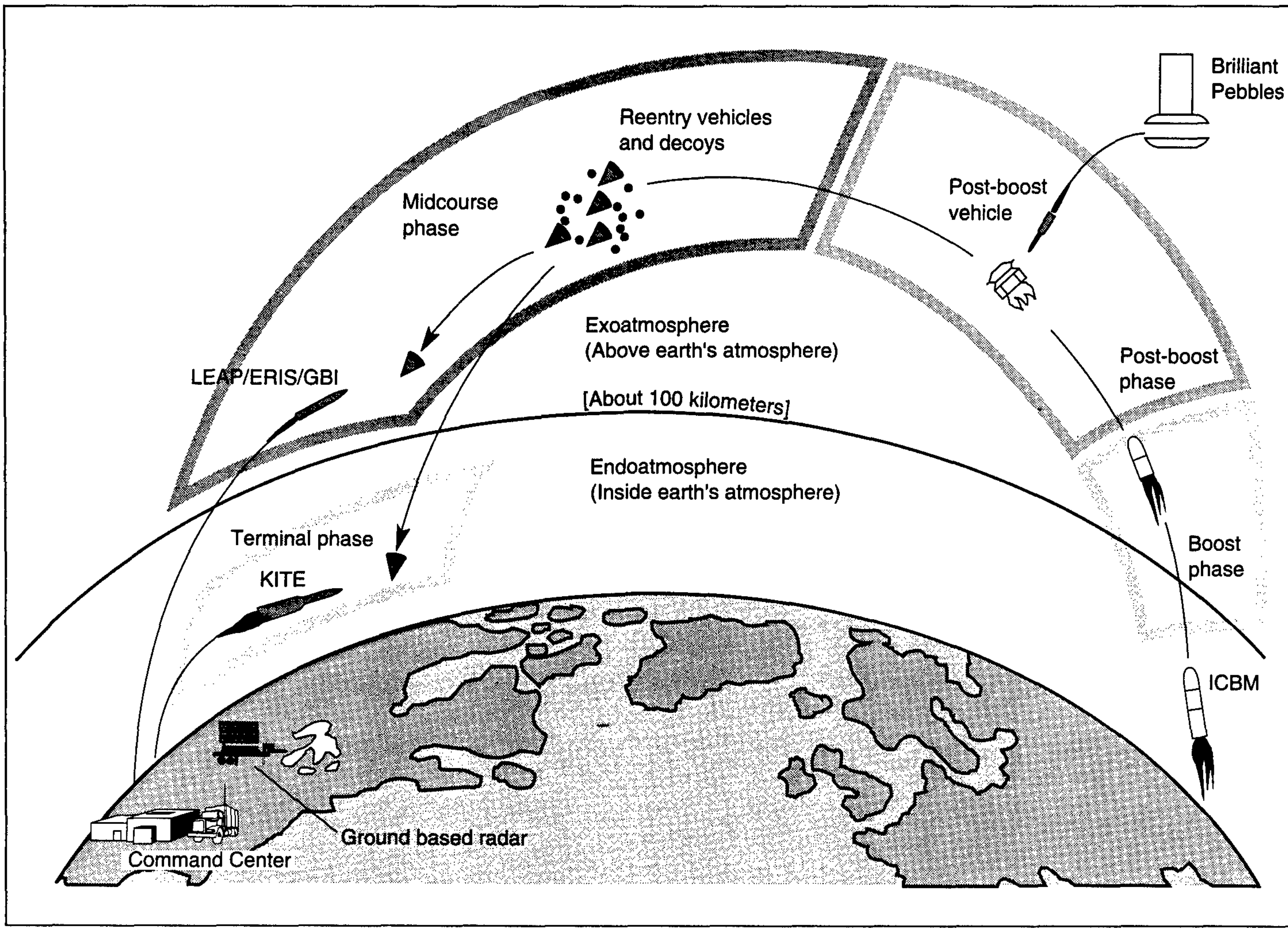
Introduction

From January 1990 through March 1992, the Strategic Defense Initiative Organization (SDIO) conducted seven flight tests of three types of kinetic kill interceptors, two ground based and one space based. The purpose of these flight tests was to show that critical technology issues were being successfully resolved. SDIO claimed that five of the tests were generally successful.

SDIO is developing various technologies for building kinetic kill interceptors, which use the energy of motion to destroy an object. According to a senior project engineer, the combined speed of the interceptor and the target in a head-on collision would be up to 30,000 miles an hour, which creates enormous destructive power. Different types of kinetic kill interceptors are needed depending on where the target is intercepted during its ballistic flight path.

The flight of a ballistic missile consists of four phases: boost, post-boost, midcourse, and terminal. (See fig. 1.1.) The boost and post-boost phases refer to the first few minutes of a missile's flight after launch until the reentry vehicles and decoys are deployed. Midcourse is the longest period of time, when the reentry vehicles and decoys are coasting along their ballistic trajectories in space above the earth's atmosphere. The terminal phase is the final minute or so when the reentry vehicles reenter the earth's atmosphere near their targets.

Figure 1.1: Ballistic Missile Defense Environment, ICBM Flight Phases, and SDIO's Three Types of Kinetic Kill Interceptors



Types of Kinetic Kill Interceptors

SDIO is developing three types of interceptors for destroying enemy missiles. One type of interceptor, called Brilliant Pebbles, would be deployed in space. It is designed to intercept targets during their boost and post-boost phases above the earth's atmosphere. (See fig. 1.1.)

A second type of interceptor would be launched from the ground to intercept targets during the midcourse phase. This type of interceptor is called an exoatmospheric (outside the atmosphere) interceptor. The most difficult problem is picking out (discriminating) the target from among various decoys that might be used to look like the target and confuse the

interceptor. SDIO has begun two series of flight tests, one called the Exoatmospheric Reentry Vehicle Interceptor Subsystem (ERIS) and the other called the Lightweight Exoatmospheric Projectile (LEAP). The goal is to develop the technology for building an interceptor.

A third type of interceptor, which would also be launched from the ground, is being developed to intercept targets during the terminal phase within the earth's atmosphere, as shown in figure 1.1. This type is called an endoatmospheric (inside the atmosphere) interceptor. The atmosphere presents a heating problem for the interceptor as it speeds through the air to intercept the target. The Kinetic Kill Vehicle Integrated Technology Experiment (KITE) program is to show that this problem can be overcome.

Objectives, Scope, and Methodology

The Chairman, Legislation and National Security Subcommittee, House Committee on Government Operations, requested that we review the accuracy of SDIO's statements about the results of flight tests of kinetic kill interceptors. As agreed, we reviewed all seven flight tests of interceptors, which were conducted from January 1990 through March 1992. All of the interceptor tests covered in this report represented very early experimental versions of kinetic kill interceptors.

Our objective was to determine the accuracy of claims made by officials representing SDIO and the Army Strategic Defense Command regarding the results of these tests. The Army Strategic Defense Command conducted the flight tests of the ground-based interceptors for SDIO. The Lawrence Livermore National Laboratory conducted the Brilliant Pebbles flight tests for SDIO. SDIO conducted the LEAP test.

We met with officials from SDIO, the Army Strategic Defense Command, and contractors working on these programs. We examined congressional hearings, SDIO reports to Congress, official news releases, press briefings, and other pertinent documentation to identify claims made regarding these tests. We reviewed test plans to find specific goals for each test and test reports to obtain actual results of the tests. We then compared actual test results, in view of the test goals, to the claims made regarding these tests to determine whether the claims accurately portrayed the test results. A professional engineer consultant provided technical assistance.

We performed our review between July 1991 and July 1992 in accordance with generally accepted government auditing standards. We discussed our preliminary work results with responsible SDIO officials and have included

their comments where appropriate. These officials raised concerns that we had not adequately explained our methodology for comparing Brilliant Pebbles test results with test goals as discussed in chapter 5. We have included additional information in chapter 5 to reflect SDIO's belief that a revised set of goals should have been used to evaluate one of the Brilliant Pebbles claims for flight test 2. As requested, we did not obtain written comments on a draft of this report.

Kinetic Kill Vehicle Integrated Technology Experiment Flight Tests Claims

Two KITE flight tests (KITE-1 and KITE-2) were conducted at the White Sands Missile Range in New Mexico. Based on our comparison of official claims with the actual test results, one of the two KITE-1 claims made about the results was inaccurate. The Army Strategic Defense Command claimed that the test results validated the shroud design. They did not. The shroud, which protects the front of the missile from high temperatures, was to open and peel away from the interceptor without hitting or damaging it. It did not and had to be redesigned with different material.

No claims of success for the KITE-2 test were made. The interceptor exploded a fraction of a second after rocket ignition, as it was moving off the launch pad, and the Army Strategic Defense Command accurately said that the test was a failure.

System Description

Since January 1986, SDIO and the Army Strategic Defense Command have been working to develop a ground-based interceptor that can hit and kill enemy nuclear warheads after they reenter the upper limits of the earth's atmosphere, an altitude of about 62 miles[1] (100 kilometers). Intercept could occur down to about 25 miles (40 kilometers). (See fig. 1.1.) Attacking a target after it is in the earth's atmosphere requires the interceptor's optical-homing sensor system to function while the interceptor is traveling through the atmosphere at speeds up to 13,000 miles per hour. This speed creates extreme high pressure on, and high temperatures in, the body of the interceptor.

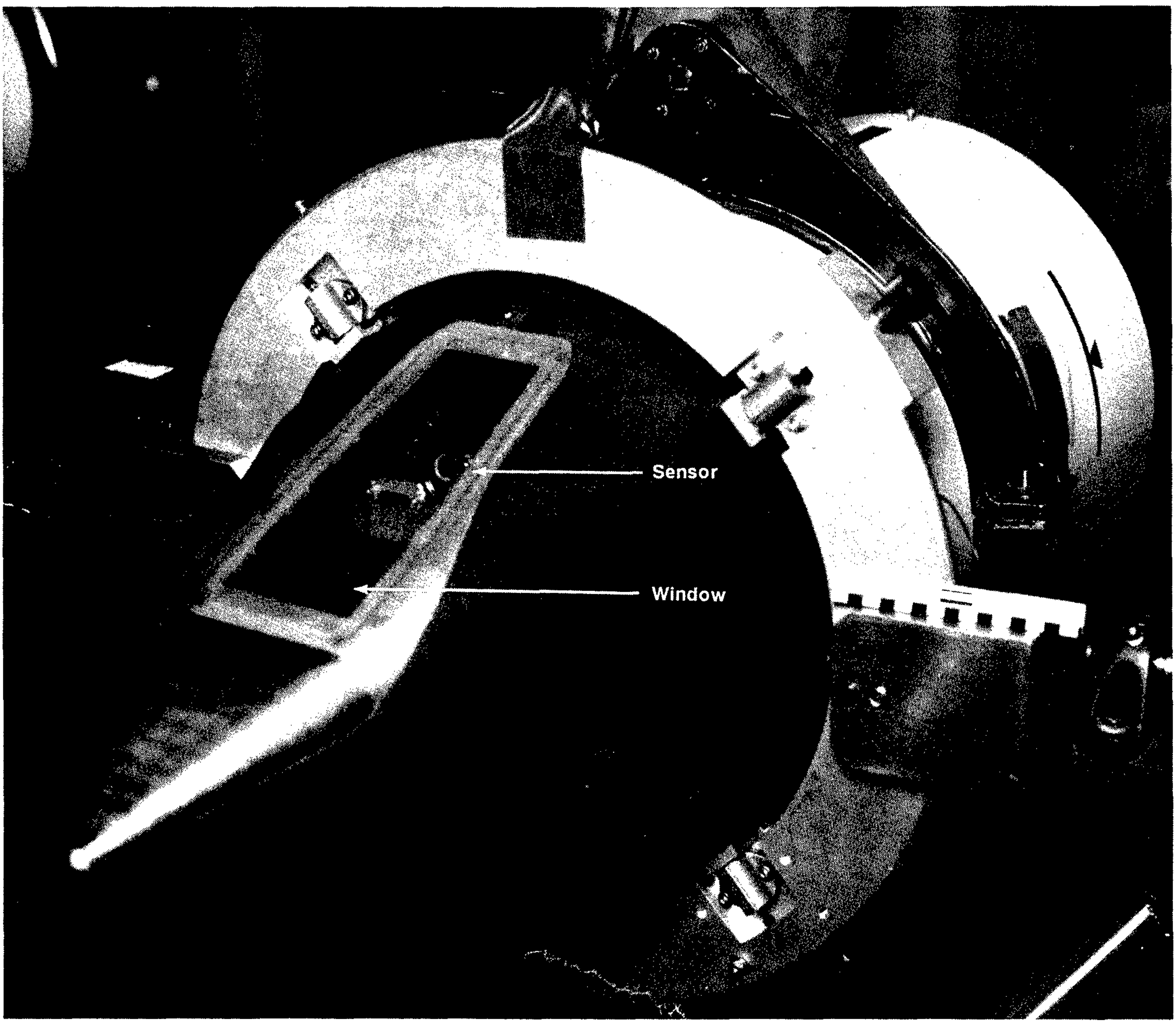
The optical-homing sensor system is inside the interceptor, which has a window for the sensor to look through and find the target. (See fig. 2.1.) During the initial part of the interceptor's flight through the densest part of the atmosphere, a shroud covers the interceptor's nose and window. The shroud protects the nose and window against the excessive heat generated by friction of the high-speed interceptor traveling through the lower atmosphere.

At 5 to 10 seconds into the flight, the interceptor's shroud is unfastened and peeled away by the air pressure to uncover the nose and window. Simultaneously with the removal of the shroud, the interceptor's cooling system is started. Without this cooling, the severe heating would make the

[1]There is not a precise altitude where the atmosphere ends, but it is generally agreed to be about 62 miles or 100 kilometers.

window appear opaque to the optical sensor. As a result, it could not see through the window to find the target.

Figure 2.1: Window for Optical Sensor

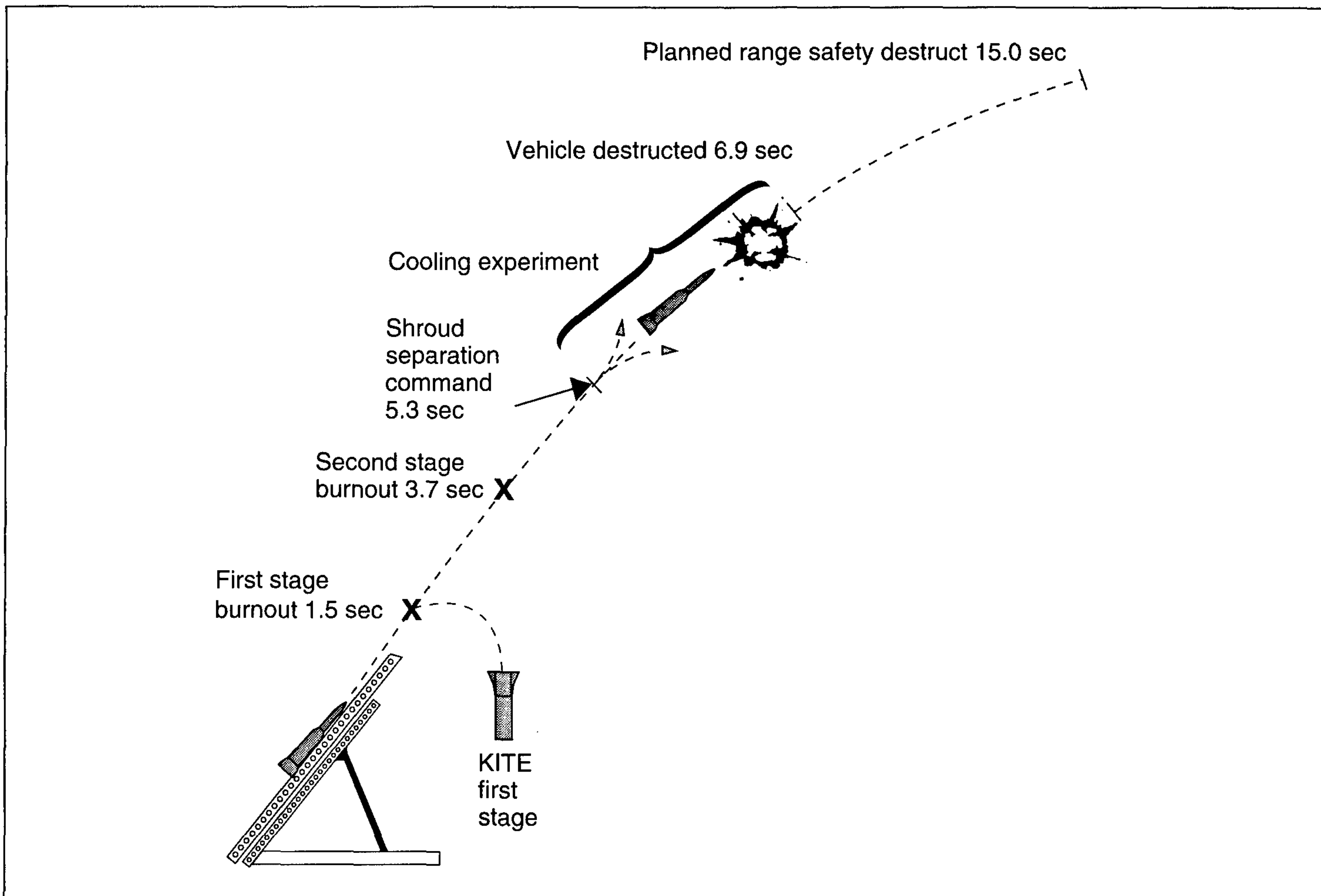


Comparison of Test Goals, Results, and Claims for First Flight Test

The KITE-1 flight test, conducted on January 26, 1990, had 12 goals. Of these, the two key technology goals were proper shroud separation and a window cooling experiment (see fig. 2.2). The purpose was to show that the shroud and the window cooling system would work properly in the earth's upper atmosphere.

The other 10 goals related primarily to achieving the proper test environment rather than resolving key technology issues. One of those 10 goals was verification of the flight termination system. The flight termination system detonated prematurely, limiting the length of the test to about 6.9 seconds.

Figure 2.2: KITE-1 Flight Test



Claim That Shroud Design Was Validated

An Army Strategic Defense Command news release issued 3 days after the KITE-1 test claimed that the flight test validated the design of the nose cone shroud. "All the critical test functions worked perfectly during the flight: the shroud came off clean and didn't impinge on the rest of the missile."

Subsequently, the Army Strategic Defense Command issued two fact sheets, one in July 1991 and the other in October 1991, still claiming that the flight test had validated the shroud design. When we discussed this matter with Strategic Defense Command project officials, they were surprised this claim was in the fact sheet. In June 1992, a new fact sheet was issued that deleted any reference to the validation of the shroud design.

This test was to demonstrate proper separation of the shroud from the kill vehicle. To meet this goal, the shroud covering the nose and simulated window of the kill vehicle was to open and peel away from the kill vehicle without hitting or damaging it.

During the flight test, the shroud separated on command. However, instead of the shroud petals "peeling back" and moving away from the nose cone without hitting and damaging the kill vehicle, the petals broke off close to the hinges attaching them to the kill vehicle and disintegrated. The pieces struck the kill vehicle.

The shroud design was not validated on the KITE-1 test as claimed, because the shroud did not separate from the kill vehicle without hitting it. The contractor's April 1990 test report for KITE-1 concluded that the shroud goal was only partially achieved since the shroud did not eject from the nose of the interceptor as required. This anomaly required a redesign of the shroud using stainless steel instead of composite material. Army project officials told us that the new design was to have been tested on the second flight test on September 23, 1991. However, as discussed below, the second flight test failed.

Project officials said that the new shroud design was successfully tested in a wind tunnel after the redesign and that they are confident the new design will operate successfully in flight.

Claim That Window Cooling System Was Validated

The Army Strategic Defense Command news release also claimed that the KITE-1 flight test validated the design of the window to withstand the intense heat generated by the high-velocity launch. It said, "All the critical test functions worked perfectly during the flight: the cooling began as planned." Finally, the Army claimed that the flight test validated the adequacy of the cooling system.

At 5.3 seconds after launch, the shroud separated and the planned 6-second cooling experiment began. The goals were to cool the window and to gather information to characterize the performance of the cooling system.

The experiment involved varying the flowrate of the coolant (gaseous nitrogen) over a simulated window, which was a steel plate. This steel plate made it possible to mount sensors to collect test information at key locations on the window. This experiment was to validate the window cooling system design and to determine the amount of coolant needed to reduce and maintain the temperature of the window below 260 degrees Fahrenheit. This is the temperature needed to keep a sapphire window transparent so the optical sensor can see through it. Project officials said this information would enable SDIO to design an efficient window cooling system for an operational interceptor and would allow the least possible amount of coolant to be carried on an interceptor. The effect would be a smaller, lighter, and less costly interceptor.

Test results show that the window was instantly cooled from 800 degrees Fahrenheit to well below the required 260 degrees. It remained cool throughout the experiment. Although the experiment was to gather information from many gauges on the surface of the simulated window for 6 seconds, most gauges were lost at shroud separation. Also, the premature detonation of flight termination system explosives destroyed the missile at 1.6 seconds into the cooling experiment (6.9 seconds into the flight test).

Although the experiment was shorter than planned, Army project engineers and their consulting engineer are confident that the cooling experiment provided sufficient information to justify concluding that the experiment was successful. The contractor's final test report assessed the window cooling experiment a success. The project engineers stated that they received sufficient information during the 1.6 seconds of the experiment to validate their computerized window cooling model and provided documents to support their position. They also said that they obtained

adequate information from the KITE-1 test to design an efficient cooling system for future interceptor flights.

The Army's consulting engineer stated that although the simulated window lost many temperature and pressure gauges, the remaining gauges, especially those located along the center line of the simulated window, worked properly throughout the experiment and collected the most essential information. We have no reason to question the engineers' position that sufficient information was obtained to validate the window cooling system design.

Comparison of Test Goals, Results, and Claims for Second Flight Test

The KITE-2 flight test was launched at the White Sands Missile Range on September 23, 1991. The missile was destroyed by the premature detonation of the flight termination system explosives while the interceptor was starting to move from the launch pad. The Army Strategic Defense Command acknowledged that the test was a failure.

This test had seven primary goals. Of these, the four key goals were to (1) verify successful shroud separation, (2) demonstrate the capability of the sapphire window to withstand stress from shroud separation, (3) verify the seeker's ability to acquire and track a normal infrared target at the outer edges of the earth's atmosphere, and (4) gather information to support characterization of boresight error and line-of-sight angle measurement noise in its operational environment.

Boresight error is the difference between the apparent line of sight and the true line of sight between the seeker and the target. The error is caused by the light bending due to the shock field, turbulence, and coolant flow over the window when the interceptor is traveling at extremely high speeds. The error constantly changes throughout the flight due to differences in air density, attitude, and speed. The information gathered would allow an interceptor's onboard computer to be programmed to compensate for the boresight error in future interceptors.

Exoatmospheric Reentry Vehicle Interceptor Subsystem Flight Test Claims

The ERIS program has conducted two flight tests above the earth's atmosphere (exoatmospheric). SDIO and the Army Strategic Defense Command made three claims about the results of these tests that we consider significant. Based on our analyses, we believe that one of these claims was inaccurate. Specifically, while the first test successfully achieved its planned goals as claimed, the claim that target "discrimination" was demonstrated is inaccurate.

The second ERIS flight test failed to intercept the target. SDIO's press releases explained why the intercept did not occur and claimed that all major goals were achieved except for intercept of the target. Our analyses of test plans and test results showed that this claim was accurate.

System Description

The purpose of the ERIS program is to identify and resolve critical technology issues associated with the use of a ground-based interceptor to kill reentry vehicles above the earth's atmosphere. The ERIS program has conducted two flight tests. In these tests, ERIS was to intercept a mock enemy reentry vehicle in a threat cluster containing the target and decoys (either one or two balloons), using different target selection techniques.

Discrimination is the process of distinguishing reentry vehicles from nonthreatening objects. A single missile may release a cluster of objects containing both. Discrimination has long been a challenging technology hurdle in missile defense. SDIO plans to use an external target acquisition and tracking sensor, such as Brilliant Eyes,[1] to do discrimination. This would permit the interceptor to operate with relatively simple seekers. It would be guided toward the target by the external sensor (e.g., Brilliant Eyes) and would be told which object in its field of view is the actual target.

An external sensor and the battle management command, control, and communications system would pass target tracks and discrimination information to the interceptor. To date, none of the sensor programs have progressed into integrated demonstration and validation tests to validate the ability to discriminate.

The sequence of functions for employment of an operational ground-based interceptor is illustrated in figures 3.1 and 3.2. Figure 3.1 represents the system functions delegated to the yet-to-be-developed external sensor and

[1]Brilliant Eyes is a space-based sensor that will be designed to do surveillance, tracking, and discrimination during the post-boost and midcourse phases.

battle management system. Figure 3.2 illustrates the interceptor functions tested in the ERIS flight tests.

Figure 3.1: Functions Performed by an External Sensor and a Battle Management Command, Control, and Communications System

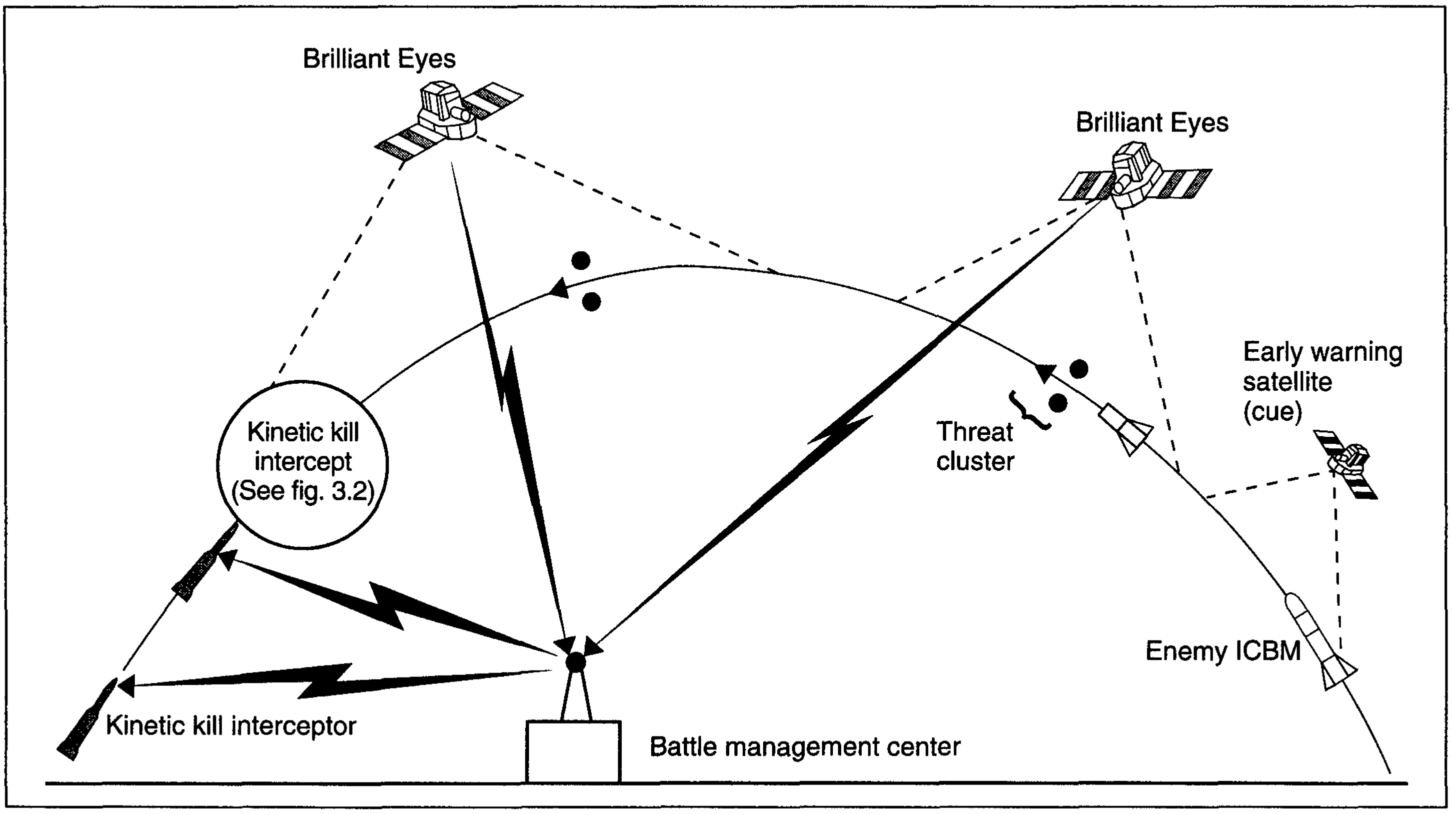
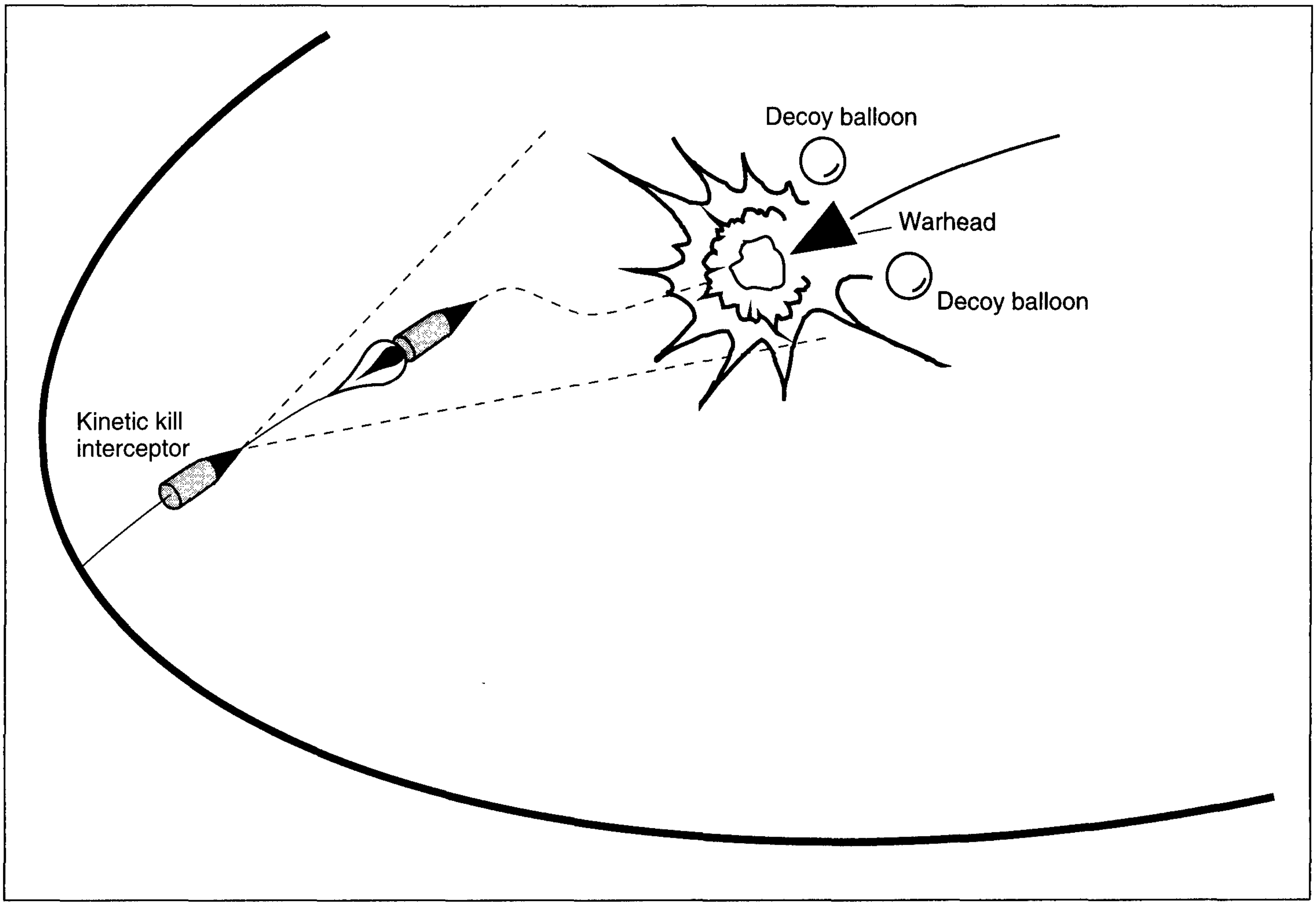


Figure 3.2: Functions Performed by a Kinetic Kill Interceptor



External Sensor and Battle Management Center Functions

An external targeting sensor, such as Brilliant Eyes, would be cued by an early warning system to expect a threat cluster.[2] It then would find the threat cluster, generate track information on the target, and provide the information to the battle management center that would launch an interceptor toward a predicted intercept point.

[2]A threat cluster contains the reentry vehicles and penetration aids deployed at virtually the same time from a post-boost vehicle.

The external sensor would continue tracking the location and direction of the cluster and pass updates through the battle management center to the interceptor during its flight toward the threat cluster.

The external sensor also would collect information on the threat cluster to decide which objects are targets and which are decoys. The information may be either in the form of (1) a threat object map that shows relative positions of the reentry vehicle and decoys or (2) a message that the "hotter" or "cooler" infrared signal in a cluster is the target. The battle management center passes the information to the interceptor in flight. (See fig. 3.1.)

Kinetic Kill Interceptor Functions

Program officials said that when the interceptor nears the threat cluster, the infrared seeker in the nose of the missile begins collecting information about the relative positions or infrared signatures of the individual objects in the cluster. The interceptor then uses the appropriate technique to select a target.

If a threat object map based on position geometry were used, the interceptor would select as the target the object that, for example, is the middle object in the cluster. If the relative signal strength of the targets were used, the interceptor would select as the target the object that, for example, has the lowest or the highest infrared signature. It would then maneuver into the path of the incoming target it has selected. A successful intercept would culminate in impact and destruction of the target.

Comparison of Test Goals, Results, and Claims for First Flight Test

The major test goals for the first ERIS flight were to demonstrate the (1) handoff of target information from a simulated battle management center to ERIS during flight, (2) target selection by ERIS using a preprogrammed threat object map, (3) ERIS' ability to select an aimpoint on the target and maneuver to it, and (4) destruction of the target.

The ERIS interceptor was launched on January 28, 1991, from the Kwajalein Missile Test Range in the Central Pacific to intercept a mock reentry vehicle accompanied by two decoy balloons launched from Vandenberg Air Force Base in California.

To provide target track information that would simulate what would be provided by an external tracking sensor, the test used information from the Global Positioning System.[3] This information was passed through the simulated battle management center to ERIS. The interceptor used this tracking information to maneuver into the vicinity of the predicted intercept point.

Simulating the functioning of the external sensor, a preprogrammed threat object map was placed in the interceptor's computer memory. The map replicated the scene the interceptor was expected to see with its infrared sensor, which functions as its eyes. Using the threat object map that provided the relative positions of the threat cluster objects and designated the middle object as the target, the interceptor should intercept the middle object in the target cluster.

During the last few seconds of the test, two decoy balloons deployed, one on each side of the target. The interceptor compared this scene, which it saw with its infrared sensor, to the preprogrammed threat-object-map scene in its computer memory. Once the interceptor's computer made a "best fit" of the scene it viewed versus the scene in its memory, it selected the predesignated target, maneuvered into its path, and destroyed it.

Claim That Test Was Successful

In a January 31, 1991, news release by the Army Strategic Defense Command, the Deputy Ground-Based Interceptor Project Manager stated that "the test flight was an unqualified success" and "we have yet to find a single objective, test or parameter that was not achieved."

Our examination of test plans, post-flight analyses, and test reports confirmed that ERIS successfully achieved all of the major goals planned for this test.

Claim That Discrimination Was Accomplished

The Army Strategic Defense Command's news release also said that "the successful interception of the reentry vehicle...was accomplished in the presence of decoys....We asked this kill vehicle not just to pass by and see that target, but to pick one out and destroy it. And it did that."

[3]The Global Positioning System is a precision navigation network providing precise positioning and navigation data for military services.

SDIO's reports to Congress have talked about testing and demonstrating discrimination with the ERIS flight tests. Prior to the ERIS test, in the 1990 Report to the Congress on the Strategic Defense Initiative issued in May 1990, the ERIS flight test was described as testing ERIS "discrimination and intercept." After the ERIS test, the 1991 Report to the Congress on the Strategic Defense Initiative issued in May 1991 stated that "this extremely successful flight experiment validates the concept of performing midcourse intercepts using basic discrimination techniques, and enhances confidence in the Ground-Based Interceptor's ability to perform more advanced discrimination."

In a videotape produced by the Army's Strategic Defense Command for release after the test, the narrator stated the following:

> Decoy balloons were released, to test the interceptor's discrimination capability. Although a successful intercept was important, of greater importance is the demonstration and confirmation of the Army's primary test objectives, involving...target discrimination and acquisition.

In a May 16, 1991, statement before the Chairman, Legislation and National Security Subcommittee, House Government Operations Committee, SDIO's Director stated that ERIS "did its own thing in...determining which of the targets to go after, whether the decoy or the target vehicle....The principal algorithms we have to prove can work in doing the discrimination task I think were effectively proven as part of that test." In follow-up clarifications to the Chairman in June 1991, SDIO said that ERIS' role in target selection "did not constitute discrimination—which in a system employing an ERIS interceptor would be accomplished by sensors external to ERIS."

In this test, discrimination was not a test goal, nor was it a capability of ERIS. The interceptor was not capable of discriminating targets from decoys. A program official said that the interceptor was preprogrammed to hit the middle object in the target complex, to show it could select and home in on a geometrically specified target. Thus, if the target complex had not deployed as planned and one of the balloons had been positioned as the middle object instead of the reentry vehicle, ERIS would have attempted to intercept the balloon, since it cannot discriminate a reentry vehicle from a decoy on its own. Therefore, the claim of discrimination was an overstatement of what occurred.

Comparison of Test Goals, Results, and Claims for Second Flight Test

A second ERIS interceptor was launched on March 13, 1992, from the Kwajalein Missile Test Range in the Central Pacific to intercept a mock enemy reentry vehicle launched from Vandenberg Air Force Base in California. The test's major goals were to demonstrate (1) receipt by ERIS of target track information in flight; (2) ERIS' ability to distinguish between two closely spaced objects, based on their relative temperatures registered on ERIS' infrared sensor; (3) ERIS' ability to select an aimpoint on the target and maneuver to it; and (4) destruction of the mock reentry vehicle. Goals 1, 3, and 4 had been successfully demonstrated under somewhat different conditions in the first ERIS test.

The new goal in this test, compared to the first flight, was testing the interceptor's ability to distinguish between closely spaced objects based on their relative infrared temperatures. The balloon was to remain close enough to the reentry vehicle so as to appear as one object when first seen by the interceptor. As the interceptor flew closer to the two closely spaced objects, its sensor would get within range to be able to resolve two images, detect their relative temperatures, and home in to hit the one it was programmed to assume was the reentry vehicle.

Program officials explained that this test assumed that the battle management center would have known whether the hotter or colder of the objects was likely to be the reentry vehicle, based on certain known conditions, and tell the interceptor. For this test, the interceptor was preprogrammed to intercept the object with the lower infrared signature, or temperature.

The second flight test was also designed to gather two-color infrared[4] data for use in developing future discrimination techniques.

During the last few seconds of the interceptor's flight, the sensor "opened its eyes" and saw two objects as one object. As the interceptor got closer to the threat cluster, it (1) saw two objects rather than one, (2) measured the infrared signatures of the objects, and (3) chose the object with the lower infrared signature (reentry vehicle) using one-color infrared data.

Then the interceptor, as programmed, began gathering two-color infrared data on the two objects. It did this for 0.8 seconds as planned and then diverted toward the reentry vehicle using one-color data. Although the

[4]Color refers to the infrared wavelength. Two color means gathering data for two wavelengths. One color means one wavelength.

interceptor maneuvered toward the reentry vehicle, it missed the target by approximately 14 feet.

Claim That Three of Four Goals Were Met

An SDIO information paper on the ERIS flight test said that all goals were met except for the final body-to-body impact of the reentry vehicle.

An Army Strategic Defense Command news release on March 18, 1992, stated the following:

> The ERIS kill vehicle performed exactly as designed....It missed the target because of an anomalous target deployment and test gathering constraints. Every test and experiment is a compromise between a full test and gathering important data. If we hadn't been interested in data gathering, we would have nailed the target. The sensors correctly identified the dummy warhead all the way in a decoy environment.

An Army Strategic Defense Command news release dated March 20, 1992, stated the following:

> ...A self-imposed requirement for the interceptor to collect maximum data, pre-intercept, for utilization across the National Missile Defense Segment of [Global Protection Against Limited Strikes], required a delay in the final divert maneuver. This delay, coupled with the particular, unexpected geometry of this target complex, proved to be just enough to preclude an actual intercept. Had the interceptor not been directed to collect this data (not required for this test), there is no doubt that an intercept would have occurred even with the unexpected target complex geometry.

Three things contributed to the failure of ERIS to intercept the target. First, the balloon deployment was abnormal in that it moved away from the reentry vehicle at a faster speed than anticipated. This anomaly placed the balloon farther from the reentry vehicle than planned. The second anomaly was a boresight misalignment caused by improper calibration. Lastly, a two-color data gathering requirement delayed the final divert maneuver of the interceptor. As a result of these three things, the interceptor was unable to divert in time to intercept the target.

During the tracking phase, the interceptor's sensor successfully distinguished the reentry vehicle from the balloon using one-color infrared data and shifted its aimpoint to the center of the target complex. The interceptor then diverted its attention from the reentry vehicle and successfully collected the two-color infrared data on both objects.

The program manager said that the test design was set up poorly because collection of the two-color infrared data interfered with the primary test

goals. The collection should have been "event driven" rather than "time driven." Then the interceptor would have collected the two-color data only until the last possible moment that a successful divert could have been accomplished. However, because the two-color data collection experiment was set up to use a finite amount of time, and because of the two test anomalies mentioned above, the interceptor missed the target.

Our analysis indicates that SDIO's claims properly represented the test results. The ultimate goal of the test (intercept of a reentry vehicle) was not achieved, but the other three test goals were successfully accomplished.

Lightweight Exoatmospheric Projectile Flight Test Claims

The LEAP program conducted a "dress rehearsal" flight test to check out test hardware, software, and instrumentation without using a new interceptor. Because this flight was not to test LEAP technology, an older projectile was used.

An SDIO press release claimed that the test was successful. Our analysis of test goals and test results indicates that this checkout flight was successful in identifying problems that needed to be corrected before the next test. SDIO also claimed that altitude and accuracy requirements were met. They were not.

System Description

LEAP is a technology program to develop the smallest, lightest, kinetic kill, exoatmospheric interceptor that emerging technology permits. The LEAP projectile has an infrared seeker, attitude control system, and small divert thrusters for steering the interceptor. The goals are to develop advanced technology; to use it to build smaller, lighter projectiles; and to test them in ground tests, hover tests, and space-flight tests. According to a LEAP program official, this technology will be used as it emerges from the program to build future ground-based interceptors.

Three different contractors are building LEAP projectiles to be used for flight testing. An Army contractor is building a version that is 6 inches in diameter, 14 inches long, and weighs about 13 pounds with fuel. Two Air Force contractors are building two other versions that weigh about 22 pounds and 40 pounds. The Army and Air Force are conducting flight tests at the White Sands Missile Range in New Mexico before conducting tests at the Kwajalein Test Range in the Central Pacific. According to a LEAP program official, the results of these LEAP tests provide risk reduction for the Ground-Based Interceptor and continue technology development for exoatmospheric interceptors.

Comparison of Test Goals, Results, and Claims for First Flight Test

The LEAP-1 flight test was conducted on February 18, 1992, at the White Sands Missile Range in New Mexico. The test was a dress rehearsal to reduce risk for future LEAP tests. The purpose was to show that the test team could deliver the projectile and target to the required altitude and the necessary proximity to each other. Because this was a dress rehearsal, an older projectile was used in place of a new expensive LEAP projectile.

Claim That Test Was Successful

An SDIO press release dated February 21, 1992, announced "the successful completion of the...LEAP program's Mission Operations Checkout flight test." A Queries and Answers paper SDIO released after the test stated that "the LEAP-1 Mission Operations Checkout flight wrung out all the procedures and techniques necessary to set up the very complex laboratory in space...."

Based on our analysis of test results and discussions with SDIO officials, we agree that the test was generally successful. Although some anomalies occurred, program officials said they understand the probable causes of the problems and made fixes for the LEAP-2 flight test.

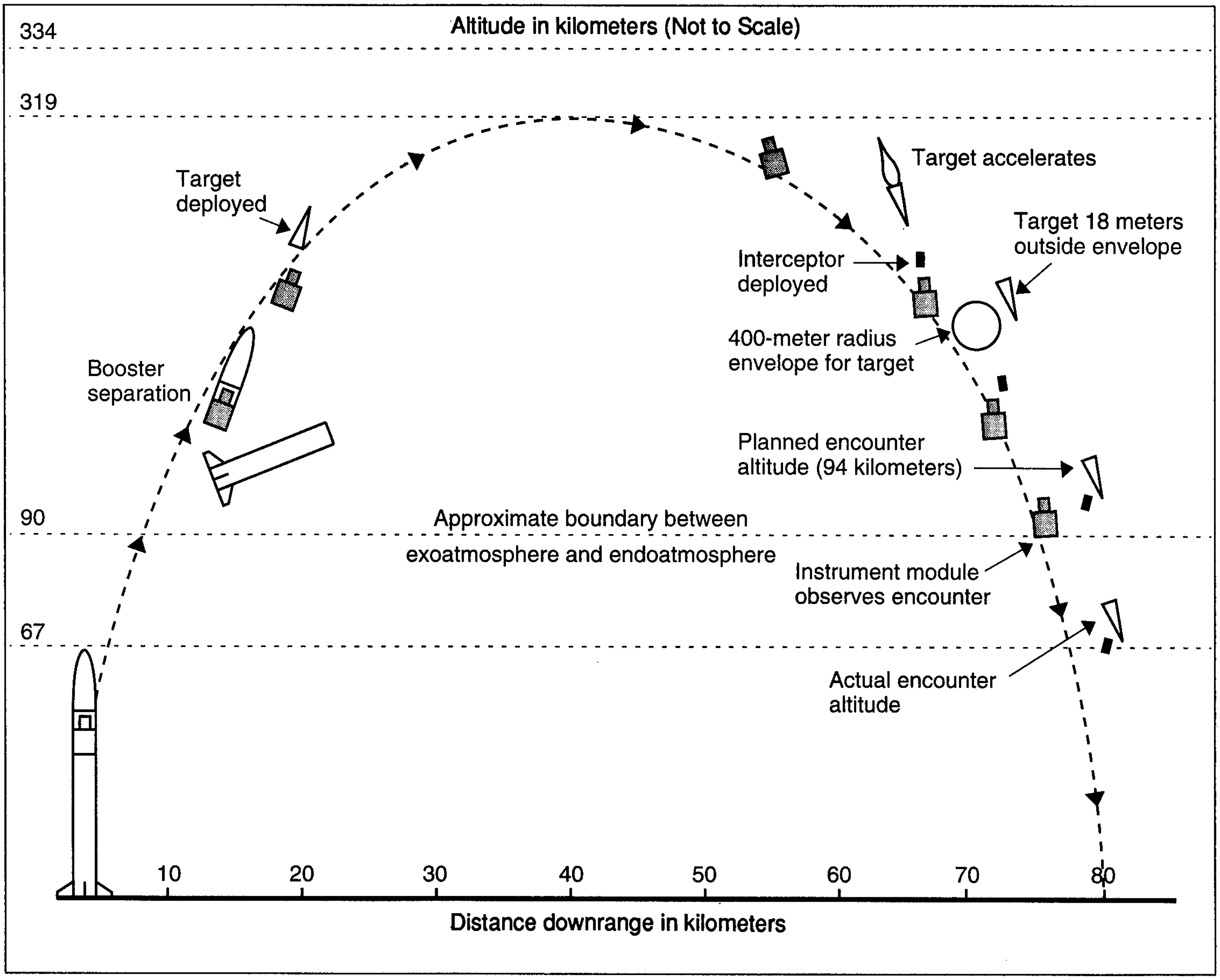
Claim That Altitude and Accuracy Requirements Were Met

The press release also stated that the experiment was lifted to an altitude of 334 kilometers. (See fig. 4.1.) It further claimed that "preliminary data...indicates the target was delivered to a point within 75 meters of its intended position, far tighter than the 400-meter [radius] envelope required for a successful mission." The Queries and Answers paper released by SDIO repeated these altitude and proximity figures. These statements to the press were not supported by the final test results. Furthermore, the statement about altitude was not supported by information immediately available after the test.

First, the projectile did not reach the 334-kilometer altitude. This altitude was needed so that the test could occur above the atmosphere at about 94 kilometers before the projectile and target fall back into the earth's atmosphere. The test report shows that the LEAP did not reach 334 kilometers, but only 319 kilometers. Altitude information was accurately known during the test, according to a test range official. A program official could not explain why the incorrect altitude was noted in the press release.

Second, the target was not delivered within the 400-meter radius volume of space at a specified distance away from the bus and projectile as claimed. The test manager was uncertain of the origin for the claim that the target was within 75 meters of its intended position. Post-flight analysis, not available at the time of the press release, showed the target was 18 meters outside the 400-meter radius volume of space.

Figure 4.1: LEAP-1 Flight Test Profile



Had SDIO been conducting an actual test rather than the dress rehearsal, the test would have been unsuccessful. A successful flight test depended on the projectile and target reaching the required altitude and then being accurately positioned relative to each other by a particular time in the flight. Neither happened. Therefore, by the time the test vehicles had been correctly positioned for the experiment, the test vehicles had fallen back into the atmosphere to an altitude of about 67 kilometers. At this altitude a successful test of an exoatmospheric projectile would have been unlikely.

Since the primary purpose of the flight test was to reduce risk for future LEAP flight tests, the LEAP-1 served its purpose of identifying problems before further testing. LEAP program and test officials said that analyses of the problems identified probable causes. Fixes were implemented for the next flight test. Program officials decided in May 1992 that risks in the LEAP-2 test setup had been reduced to a level acceptable to proceed with that test. After the flight, SDIO officials said that none of the anomalies seen on LEAP-1 reoccurred on LEAP-2. We did not review the results of LEAP-2.

Brilliant Pebbles Flight Test Claims

Brilliant Pebbles is a space-based interceptor that is being designed to detect and destroy ballistic missiles during their boost and post-boost flight phases. If developed and deployed, hundreds of interceptors would orbit the earth.

Brilliant Pebbles space experiments were conducted in August 1990 and April 1991. The first test ended soon after launch. A malfunction in launch equipment precluded satisfying any major test goals. In a press release 2 days after the test, SDIO noted the malfunction and indicated that some useful information was obtained. We agree.

The second flight test was partially successful. However, we believe that the three SDIO claims about the success of the test were overstated. One of those three claims, if measured against the reduced goals in the Mission Experiment Description rather than the original goals in the Integrated Test Plan, would be reasonably accurate. Development problems precluded meeting the original goals and schedule. However, SDIO did not disclose that it had reduced the goals of the test. Instead, it continued to refer to the original goals in the Integrated Test Plan rather than the reduced goals in the Mission Experiment Description, which was prepared shortly before the flight test. Therefore, we have evaluated the accuracy of SDIO's claims against the goals in the Integrated Test Plan.

Test Description and Goals

SDIO, with Lawrence Livermore National Laboratory, had planned to do 12 flight tests, grouped into 4 phases, to demonstrate that Brilliant Pebbles was ready to enter engineering and manufacturing development. Flight tests 1 and 2, which made up Phase I of the test series, were to have been tested using two different scenarios. The first test would be at night with the sensor looking into deep space. The second test would be in daylight with the sensor looking at the earth. Both tests were launched from Wallops Island, Virginia, out over the Atlantic Ocean.

The Secretary of Defense, in the May 1990 Report to the Congress on the Strategic Defense Initiative said that "the Brilliant Pebbles tests this summer will demonstrate the capability to acquire and track an object." SDIO's Director, in a June 1990 presentation to the Defense Acquisition Board, said that the first two tests would emphasize the critical technical issues of target acquisition, target tracking, and control of the interceptor through its computer and software.

The Integrated Test Plan, updated by SDIO in July and December 1990, had four goals for the first two Brilliant Pebbles flight tests.

1. Demonstrate the ability to acquire stars, navigate, and stabilize the interceptor using the attitude control system.

2. Demonstrate the ability of the interceptor to detect, acquire, and track an accelerating target's rocket plume.[1]

3. Gather data with infrared and ultraviolet sensors.

4. Demonstrate basic hardware performance versus design requirements in a realistic environment.

After the first test failure, program officials said they imposed more management discipline and realism on the test, including documenting more realistic test expectations than the Integrated Test Plan contained. SDIO prepared a Mission Experiment Description for flight 2 shortly before the test that listed significantly reduced goals for that test. SDIO said its claim of 90-percent success was based on these goals rather than the original goals. The goals were reduced due to two problems. First, SDIO had learned from testing that the performance of some hardware components was less than originally expected. Second, and more importantly, according to SDIO's Test Director, software development was difficult and slow, and was behind schedule. Program officials said they proceeded with tests with the less capable software and hardware to contain schedule slippage and cost growth and to obtain basic data on performance of attitude control system components in space.

However, the original goals remained in the Integrated Test Plan published for the sixth time in December 1990, between flights 1 and 2. We have used these goals to evaluate the accuracy of SDIO claims for the first two flight tests. However, we include SDIO's comments concerning the reduced goals following our evaluation of SDIO's claims against the original goals.

[1]The plume is the visible and invisible exhaust from a rocket engine.

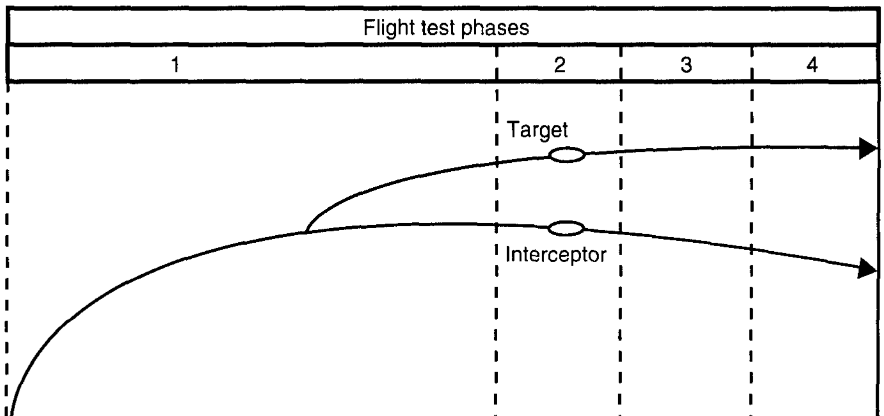
Comparison of Test Goals, Results, and Claims for First Flight Test

The first flight test was launched on August 25, 1990. The test's usefulness ended when an explosive bolt released prematurely 81 seconds after launch. This prevented transmission and recording of performance information from the interceptor. No information was collected on how the interceptor performed against its test goals. SDIO reported the malfunction and stated that some useful information was obtained on how the launch vehicle and test range instrumentation worked. We agree.

Comparison of Test Goals, Results, and Claims for Second Flight Test

The second flight was launched on April 17, 1991. There were four test phases, as shown in figure 5.1. The figure also shows the goals that the test was to meet. Phase one of the flight test involved launching the booster with the target and the interceptor to the proper altitude, deploying the target and interceptor on their individual flight paths, and turning the interceptor 180 degrees so its sensors could observe the target. The interceptor was then tested during phases two through four. Of the four goals, one was not met and the other three were partially met.

Figure 5.1: Flight Test 2 Profile, Goals, and Results



Goals / Description of test phases	Launch, fly to test site, deploy target and interceptor, turn interceptor 180 degrees and begin test	Interceptor tracks target	Interceptor makes large-angle maneuvers	Interceptor makes small-angle maneuvers	Did test results meet goals?
Demonstrate ability to acquire stars, navigate, and stabilize the interceptor using the attitude control system.					Partially
Demonstrate ability of the interceptor to detect, acquire, and track an accelerating target's rocket plume.					No
Gather data with infrared and ultraviolet sensors.					Partially
Demonstrate basic hardware performance versus design requirements in a realistic environment.					Partially

No testing performed

Testing performed to meet goal

Goals Versus Results

We compared the four test goals in the Integrated Test Plan and the test results to determine if each goal was met. Each goal and the applicable test results are discussed below.

Demonstrate Attitude Control System Performance

This goal called for the interceptor to acquire stars, navigate, and stabilize itself during test phases two, three, and four while using the complete attitude control system to control the movement of the interceptor. Accurate control of the interceptor is essential to successfully kill reentry vehicles carrying nuclear warheads. The system includes the star tracker, computer and software, inertial measurement unit, and cold gas thrusters. We believe this goal was only partially achieved. The attitude control system was not successfully demonstrated in test phases two and three, but was demonstrated with some degree of success during test phase four.

During test phase two, the attitude control system was to be tested while acquiring and tracking a target. Because the interceptor never acquired and tracked the target, this portion of the attitude control system test was not successful.

During test phase three, the attitude control system was to be tested by performing several large angle maneuvers. Although these maneuvers were done, they were not accomplished with the expected degree of accuracy. The test report attributed the accuracy problem to the inertial measurement unit's errors, which were worse than expected. The interceptor's maneuvers were made using only input from the inertial measurement unit, uncorrected by data from the star tracker. The complete attitude control system was not integrated during this phase as the Integrated Test Plan required.

The planned test of the fully integrated attitude control system was done only during small angle maneuvers in test phase four. Although the interceptor's stability was improved, the turns performed still did not meet expectations with regard to accuracy. During this phase, the interceptor software used data from the star tracker and partially corrected the errors from the inertial measurement unit's gyros, allowing the interceptor to improve its stability. However, the attitude control system software did not work as intended when using data from the star tracker. The software mixed the data from two scenes of stars it actually saw to create a composite third star scene, which it then used for directing the interceptor. The Livermore test director said that this problem accounted for only a small part of the inaccuracy in the small angle turns.

In addition, the software could not estimate future errors of the gyros because the performance of the gyros was so poor. As a result, continuous utilization of star tracker data would have been necessary to satisfy the Brilliant Pebbles stability requirement over time. Independent test

evaluators noted that the ability of the interceptor to utilize star tracker data while tracking a target was limited due to computer capacity.

Demonstrate Interceptor Can Acquire and Track Target

This goal was not met. During phase two of the flight test, the interceptor was to demonstrate that it could acquire and track a target, but it did not. The failure to execute the 180-degree turn accurately during test phase one meant the interceptor never had the opportunity to test acquisition and tracking capabilities because the target was not within the field of view of the sensor.

The goal in the Integrated Test Plan was to have the interceptor detect, acquire, and track the target's rocket plume using predictive tracking software. However, when software development difficulties arose, predictive tracking software was deleted from the test. As a result, even if the interceptor had tracked the target, the goal of demonstrating the predictive tracking software could not have been met.

Gather Infrared and Ultraviolet Data

Test results show that this goal was partially met. The Integrated Test Plan called for collecting data on the target and background with the infrared and ultraviolet target acquisition and tracking sensors during phases two, three, and four of the flight test.

One part of the goal was to collect scene data on what the target rocket's plume looked like to the infrared and ultraviolet target acquisition and tracking sensors during test phase two. This would be useful in designing and validating target tracking software. Since the target was not acquired and tracked, this part of the goal was not met. In addition, the ultraviolet sensor was not turned on during this phase of the test.

Another part of the goal was to collect background data with these sensors. This was to occur during the remainder of phase two and all of phases three and four. Some background data were obtained by the infrared sensor, but the ultraviolet sensor recorded only its own noise.

Demonstrate Basic Hardware Performance

This goal was partially met. Although no criteria were established for assessing hardware performance, the test report said that useful data were obtained and some hardware performed to expectations and some did not.

Performance of the inertial measurement unit was unacceptable, due to unpredictable errors in the gyros used. Although SDIO knew before the

flight that performance of the inertial measurement unit might be marginal, actual performance was worse than expected. This inertial measurement unit had been selected to meet the original, expedited decision schedule the President had mandated for the program. It was to be replaced with a better unit in subsequent tests. The test report concluded that these gyros "were not sufficiently stable to provide adequate reference for the experiment."

The ultraviolet target tracking sensor was never turned on during test phase two as planned. The primary function of this sensor was to observe the solid rocket plume. However, the revised test plan eliminated this test of the ultraviolet sensor. The sensor was turned on after the acquisition and tracking phase was completed, but recorded only its own noise levels.

The infrared target tracking sensor also was not tested in its primary function of acquiring and tracking a target. Although the sensor was turned on during test phase two, the target was never acquired and tracked. As a result, measurements of the sensor's performance when tracking a target were not obtained.

The star tracker performed above expectations, according to the test report. The cold gas attitude control thrusters and the mechanical structure all operated nominally (satisfactorily), according to the report.

Claims of Success Overstated

We believe the following statements made to the public and Congress overstated the test results and technical progress represented by the test:

- The test was a 90-percent success and all test objectives were fully achieved except for the acquisition and tracking of the target.
- The test was the second in a series of increasingly sophisticated tests.
- This test completed Phase I testing.

90-Percent Success

SDIO characterized the test as 90-percent successful. However, when compared to the original goals in the Integrated Test Plan, the 90-percent success statement significantly overstated test results. Nothing was obtained for one goal and the other three goals were only partially satisfied. While the calculation of a percentage depends on assumptions made about relative importance, or "weights" of the goals, results did not reasonably indicate that 90 percent could be supported. SDIO officials explained that the 90-percent success claim was based on the reduced

goals for the flight test in the Mission Experiment Description and not the goals in the Integrated Test Plan.

In the press briefing the day after the test, the Program Manager characterized the test as "all in all...about a 90-percent success." When challenged by the Chairman of the Legislation and National Security Subcommittee during a hearing on May 16, 1991, about SDIO's claim, the SDIO Director reiterated the claim and said that the test "accomplished all of the main objectives of the test."

In a letter to the Chairman a few weeks later, he provided additional information in further response to the Subcommittee's concerns that SDIO was misleading Congress about test results. The Director said that he stood by SDIO's characterization of the experiment's success. He said that the Committee's questions about the claim did not reflect a complete understanding of the four test goals as further defined in the Mission Experiment Description. He acknowledged that SDIO had not always explained in detail its test objectives and how its experiments met those objectives and that this could create confusion and misunderstanding about SDIO's claims of success. There was nothing in the letter explaining that there were significant reductions in test goals, other than the phrase "further defined." Instead, the Director's letter reiterated the four test goals of the Integrated Test Plan.

As part of our review of the accuracy of the claim, we asked SDIO for its basis for the claim. The Brilliant Pebbles Test Director told us that the 90-percent success statement was his qualitative assessment of how well the test went when compared with a revised set of goals documented shortly before the second test to reflect more realistic expectations than were in the Integrated Test Plan. He said the statement conveyed that the test was highly successful in terms of the information SDIO then expected to obtain from the test. After the first test failed, the Test Director explained that SDIO had time to formally document what he considered to be realistic goals for the next test. He said the goals as described in the Integrated Test Plan were not realistic using the hardware and software then available. The Mission Experiment Description was prepared and distributed to the test team with a substantially revised set of six goals. Brilliant Pebbles program officials said the test met five of the six goals, which was an 83-percent success. This was probably a reasonably accurate claim if measured against the substantially reduced test goals. However, the goals were never adequately disclosed outside SDIO.

We found these six revised goals to be significantly different than the original four goals in terms of what technical performance was to be demonstrated. The goals were reduced to accommodate software and hardware problems in the experimental prototype interceptor. The revised test was of a less capable prototype, tested over a more limited range of operation than originally intended. In addition, criteria for assessing success in meeting goals were dropped for five of six goals, so that simply measuring performance was defined as successfully meeting the goal.

Increasingly Sophisticated Tests

The press release the day after the test also said that this "was the second in a series of suborbital experiments with each increasing in performance and sophistication." We believe that this is an inaccurate description of the tests that had been conducted. If the first two tests had been conducted as planned, this statement would have been true. However, SDIO decided to repeat the first test rather than do the second test.

SDIO had planned to do 12 flight tests grouped into Phases I, II, III, and IV. Flight tests one and two, which made up Phase I, were to have been tested using two different test scenarios. The first test would be at night with the sensor looking into deep space. The second test would be in daylight with the sensor looking at the earth. The second test would have been more difficult than the first. Because the first test yielded no data, the second flight instead repeated the first flight's nighttime plan.

Completion of Phase I

During the same press briefing in which the above claims were made, the Program Manager said, "This completes Phase I of our experiment program." His statement indicated that the program had proceeded successfully through Phase I and was ready to begin Phase II of testing. However, we believe these statements could give a false impression of the progress the program had made to date. We believe that Phase I was completed only in the sense that SDIO had decided to proceed into Phase II.

Phase I accomplishments were significantly less than planned. A primary focus of the Phase I test series was to demonstrate in each test that the interceptor could track a target using the predictive tracking software. This was not done because the predictive tracking software could not be

developed in time to use on either test. In addition, testing against increasingly difficult viewing backgrounds was not done. According to the Integrated Test Plan, these capabilites were to be demonstrated before proceeding into Phase II and attempting to intercept a target. These capabilities will now be demonstrated during Phase II. As a result, the program has not progressed as intended during Phase I.

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